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PATENT APPLICATION

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REMOTE CONTROL FOR A HOSPITAL BED

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REMOTE CONTROL FOR A HOSPITAL BED

Reference to Priority Applications

[0001] This application claims benefit of U. S. Provisional Application No. 60/202,283, entitled "Patient Point of Care Computer System", filed May 5, 2000; U. S. Provisional Application No. 60/202,284, entitled "Remote Control for a Hospital Bed", filed May 5, 2000; and U. S. Provisional Application No. 60/229,136, entitled "Patient Point of Care Computer System", filed August 30, 2000.

Cross Reference to Co-Pending Applications

[0002] The disclosures of co-pending U. S. Application No. ___/_____, entitled "Patient Point of Care Computer System", filed May 4, 2001; and U. S. Application No. ___/_____, entitled "Hospital Monitoring And Control System And Method" filed May 4, 2001 are incorporated herein by reference.

Background and Summary of the Invention

[0003] The present invention relates to beds, controllers, and monitoring devices. More particularly, the present invention relates to a remote control for controlling and monitoring beds used in a hospital.

[0004] Hospital beds have evolved over time from ordinary beds providing mainly a resting surface into sophisticated medical devices. Current hospital beds allow for the height of the resting surface to be adjusted and provide an articulated resting surface having at least two bed portions that are moveable relative to each other. Some conventional hospital beds also include mechanisms for placing the resting surface in Trendelenburg and reverse Trendelenburg positions. Typically, the configuration of the resting surface is adjusted by depressing buttons on a fixed panel located in the guard rail of the bed or on a wired remote control. Wireless patient remote controls have also been developed.

[0005] In addition, some modern beds incorporate communication capabilities such as a nurse call button and two way communication to a nurse's station. Communication systems typically are mounted in the guard rails of the bed and are hard wired through a cable extending from a control unit in the bed to a port in the wall of the room or into a port on a

patient station which is connected to the hospital communication network, such as a phone system or local area network. During the transport of the bed from room to room, the cable either needs to be draped over the patient or stored within the bed. In addition, the cabling may be inadvertently pulled out of the wall port thereby damaging the connector, the cable or the wall.

[0006] Some beds also include various monitoring and testing equipment. One example is a bed scale to allow weighing of the patient without requiring the patient to exit the bed. Another example is a bed exit system that detects when a patient is preparing to leave or has left the bed. Yet another example is an incontinence detection system that monitors whether an incontinence event has occurred. Patient physiological monitors are also often located on or adjacent to the bed. Monitoring and testing equipment can be connected to the hospital communication network through a cable. Determination of the status of bed monitoring and testing equipment requires that the caregiver be at a particular fixed location or is done with wide area alarms or visual indicators.

[0007] Caregivers often must tend to several patients in different rooms. Thus, a device which permits a caregiver to receive bed status or patient status information from multiple beds while the caregiver is located away from the beds and away from a central nurse station would enhance caregiver efficiency. In addition, a device that permits a caregiver to operate a bed or check bed status remotely without the need to touch any buttons or other parts of the bed would reduce the likelihood of transmitting infection between the caregiver and the patient.

[0008] According to an embodiment of the present invention, a bed includes a wireless data connection to an electrical communication network in a hospital or other facility. The bed includes a transceiver which transmits and receives data from a transceiver coupled to the communication network. Therefore, a cable data connection is not required.

[0009] According to another embodiment of the present invention, a hand held controller includes an input device to permit a caregiver to control at least one function on a bed such as deck articulation or other movement of the bed. The controller also includes a transmitter which transmits a caregiver identification signal to a tracking system in a building. Therefore, the controller is a single unit which provides both bed control functions and functions of a locator badge.

[0010] Pursuant to another embodiment of the present invention, a system automatically locates a caregiver and then transmits bed status information or patient information to a remote control carried by the caregiver when the caregiver is at a remote location. This information may be displayed on a display screen on the remote control. The caregiver can communicate with the patient via the remote control using an input device. The caregiver can also speak to the patient at the remote location using a speaker and microphone on the remote control.

[0011] The exemplary system of the present invention prevents the status of bed lockouts from being changed without an authorized caregiver within the room. When the caregiver enters the room, the bed transceiver receives the caregiver identification signal from a caregiver badge. After a control unit authenticates the identification signal, control unit then permits the bed lockout status to be changed. The bed lockout controls prevent the patient on bed from actuating certain controls. These lockouts are typically actuated by pressing a button or a combination of two or more buttons on the bed to lock out various bed controls, environmental controls, or other functions.

[0012] An illustrated embodiment of the present invention is designed for use with beds which are movable from a generally flat bed position to a chair position. In this embodiment of the present invention, the bed is unable to move to a chair position unless an authorized caregiver is located within the room. Again, the control unit must receive and authenticate the identification signal from caregiver badge before the bed is permitted to move to the chair position.

[0013] In another illustrated embodiment, the status of patient environmental controls adjacent a bed is automatically altered when caregiver enters the room. For example, the sound on TV/radio device may be muted and specific light sources are activated when the caregiver enters the room. A bed transceiver receives the caregiver identification signal. After the control unit authenticates the identification signal, the control unit instructs TV/radio device to mute all sound and the light source to activate specific lights.

[0014] Additional features of the invention will become apparent to those skilled in the art upon consideration of the following detailed description of the illustrated embodiments exemplifying the best mode of carrying out the invention as presently perceived.

Brief Description of the Drawings

[0015] The detailed description particularly refers to the accompanying figures.

[0016] Fig. 1 illustrates a caregiver controlling a multitude of beds with a remote control.

[0017] Fig. 2a illustrates a first embodiment of a hospital bed.

[0018] Fig. 2b illustrates a second embodiment of a hospital bed.

[0019] Fig. 3 illustrates a hospital ward in which a location and tracking system has been employed.

[0020] Fig. 4 illustrates an embodiment of the remote control incorporating features of the present invention.

[0021] Fig. 5 shows a block diagram representation of a hospital bed, a docking station and a caregiver badge.

[0022] Fig. 6 shows a block diagram representation of the monitoring controls of the hospital bed.

[0023] Fig. 7 shows a block diagram representation of the record keeping controls of the hospital bed.

[0024] Fig. 8 shows a block diagram representation of the frame and resting surface controls of the hospital bed.

[0025] Fig. 9 shows a block diagram representation of the testing controls of the hospital bed.

[0026] Fig. 10 shows a block diagram representation of the communication controls of the hospital bed.

[0027] Fig. 11 shows a block diagram representation of the environmental controls of the hospital bed.

Detailed Description of Exemplary Embodiments

[0028] While the invention is susceptible to various modifications and alternative forms, exemplary embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit the invention to the particular forms disclosed, but on the contrary, the

intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

[0029] Fig. 1 depicts a hospital bed 100 having a wireless connection to a hospital communications and data networks and having a wireless connection to a hand held caregiver remote control 150 which in an exemplary embodiment includes a personal data assistant such as a 3Com Palm Pilot or a Handspring Visor. In preferred embodiments, hospital bed 100 is coupled to a patient/caregiver call system and a caregiver location and tracking system, such that bed status or patient status information is delivered directly to an interested caregiver regardless of the caregiver's location within the facility. Additional details concerning the structure and function of the patient/caregiver call system and the caregiver location and tracking system are disclosed in U.S. Patent Nos. 5,561,412; 5,699,038 and 5,838,233 which are incorporated herein by reference. Generally, the call system allows for communication between the patient and caregiver 110 while the caregiver location and tracking system tracks the location of caregiver 110 throughout the healthcare facility.

[0030] Referring to Fig. 5, a hospital bed 100, a docking station 105 and a caregiver 110 are represented schematically. A wireless two-way docking connection 120 is established between hospital bed 100 and docking station 105 through a first bed transceiver 125 on bed 100 and a docking transceiver 130 on docking station 105. The word "transceiver" is used throughout this application for conventional transceivers, transmitters, receivers, or a combination of a separate transmitter and a separate receiver. A wireless two-way caregiver connection 135 is established between a second bed transceiver 140 on bed 100 and a caregiver transceiver 145 on the remote control 150 carried by caregiver 110. Caregiver connection 135 is activated by the detection of a caregiver identification signal 155 generated by a caregiver transmitter 158 on a caregiver badge 160 and received by the second bed transceiver 140 or by a receiver 142 on the docking station 105.

[0031] The caregiver remote control 150 includes a processor 153, an input device 155 and software programs executed by the processor 153 and designed to control the functions of the bed 100. When caregiver 110 enters the proximity of bed 100, bed transceiver 140 detects the caregiver identification signal 155 broadcast by the badge 160 through transmitter 158 (Fig. 5). The detection of caregiver identification signal 155 activates the controls of bed 100 and prepares a control unit 175 of bed 100 to receive instructions

from remote control 150. Without the detection of caregiver identification signal 155, bed 100 will not respond to signals sent by remote control 150.

[0032] Fig. 1 shows a pictorial view of caregiver 110 controlling four individual hospital beds 100a, 100b, 100c, 100d with the remote control 150 in a single room 70. Caregiver badge 160 sends out a caregiver identification signal 155 which is received by bed transceivers 140a, 140b, 140c, 140d and a overhead transceiver 167. Overhead transceiver 167 communicates the identification signal 155 to the master station 170 (Fig. 5) of the location and tracking system either over a hard-wired or wireless connection. The location and tracking system records the location of the caregiver 110. Bed transceiver 140a, 140b, 140c, 140d also detect identification signal 155 thereby activating caregiver connections 135a, 135b, 135c, 135d. Alternatively, bed transceivers 140a, 140b, 140c, 140d transmit bed identification signals which when received by the remote control 150 activates caregiver connections 135a, 135b, 135c, 135d by causing the remote control 150 to transmit the remote control signals such that the remote control signals identify the bed that the remote control signals are intended. Caregiver 110 can remotely monitor, update and control beds 100a, 100b, 100c and 100d over caregiver connections 135a, 135b, 135c, 135d. Using unique identifiers for each of the beds 100a, 100b, 100c, 100d the caregiver 110 can select through remote control 150 to control one or more of the beds and not control the remaining beds.

[0033] Fig. 4 illustrates an alternative embodiment of the remote control 150. In this embodiment, the remote control 150 includes a display screen 151 for displaying information on the remote control 150 such as information related to the bed status, patient status, information related to the patient monitoring devices, care information, personal information, or the like. A video image of the patient may also be displayed on screen 151. Data for the display screen 151 is received by transceiver 145 through the data transmission techniques discussed herein. Transceiver 145 is coupled to processor 153. The remote control 150 further includes an input device 155 coupled to the processor 153 to permit the caregiver 110 to enter information or control commands into the remote control 150 for transmission to the bed or other remote location, and permits the caregiver 110 to select which bed or beds the information or control commands are transmitted. The input device 155 may include, for example, control buttons, a keypad, a pen-based or stylus-based input, voice recognition input, touch screen input, bar code scanner or other suitable input devices commonly

available on laptop computers.

[0034] The Fig. 4 embodiment integrates the features of the badge 160 with the remote control 150. Badge 160 is therefore also coupled to the transceiver 145 of the remote control 150 or to a separate transmitter on the remote control 150. Therefore, the single remote control 150 provides a handheld controller that acts both as an identification badge for the caregiver 110 and as a bed controller for controlling various functions of the bed as discussed herein. The remote control 150 also illustratively includes a speaker 159 and a microphone 160 to permit voice communication between the caregiver 110 and a patient located on the bed 100 or between the caregiver 110 and another caregiver located at a remote location. The remote control 150 of the present invention permits the caregiver 110 to be automatically located at a remote location and then allows the caregiver to communicate directly with the patient using the remote control 150 transceiver 145 or separate nurse call system located in the hospital.

[0035] The threat of infection is reduced when caregiver 110 uses the remote control 150 to control the bed 100, as opposed to conventional methods, because no physical contact is required between bed 100 and caregiver 110. However, preferably bed 100 has a duplicate set of at least a portion of the controls on remote control 150 in case caregiver 110 does not have remote control 150 or in case remote control 150 malfunctions.

[0036] Fig. 2A shows a first embodiment of bed 100 wherein the bed has a control box 103 which allows the patient or caregiver to control bed 100. Control box 103 is connected to bed 100 through cable 107. Alternatively, control box 103 is in wireless communication with bed 100 through bed transceiver 140. Fig. 2B shows a second embodiment of bed 100 having a control box 109 embedded in a siderail 101a of bed 100. Control box 109, in one embodiment, is an integral part of siderail 101a. In a preferred embodiment, control box 109 is removably coupled to siderail 101a, thereby allowing the patient or caregiver 110 to position control box 109 at convenient locations. Control box 109 is either connected to bed 100 through a cable or is in wireless communication with bed 100.

[0037] Fig. 3 is a pictorial view of a hospital ward 80 having three patient rooms 90a, 90b, 90c, a staff area 90e containing a nurse call station 168, and a fifth location 90d wherein caregiver 110 is currently located. The location and tracking system tracks the location of caregiver 110 by monitoring which overhead transceiver 167 receives caregiver identification

signal 155. In Fig. 3 overhead transceiver 167d is receiving caregiver identification signal 155, thereby indicating that caregiver110 is located in the vicinity of transceiver 167d.

[0038] In one embodiment, the location of caregiver 110 is tracked through overhead transceivers 167 and patient stations 165 (Fig. 5) which are incorporated into docking station 105. Patient station 165 is hard wired to master station 170 and a plurality of nurse stations 168. Patient station 165 includes a transceiver 142 which detects caregiver identification signal 155. The incorporation of transceiver 142 allows for the location of a caregiver to be tracked more closely. For example, the location of a caregiver in a room with four beds is known down to the bed the caregiver is closest to not only the room the caregiver is located within. Three different functions of the present invention will now be described with reference to Fig. 3.

[0039] First, the present invention allows for a patient to call a caregiver 110 independent of the location of the caregiver within the ward 80. A patient in bed 100a in room 90a requires the assistance of caregiver 110. Bed 100a sends this request over docking connection 120a to the master station 170. The master station then queries the location and tracking system for the location of caregiver 110. The master station then sends an alert signal 169 to the remote control 150 of caregiver 110 from overhead transceiver 167d. In one embodiment, remote control 150 and caregiver badge 160 are combined into a single unit as shown in Fig. 4. In another embodiment the master station sends an alert signal to the caregiver badge 160. The remote control 150 then alerts caregiver 110 of the nurse call request submitted by the patient in bed 100a. In one embodiment, caregiver 110 communicates with the patient remotely either through badge 160 or remote control 150.

[0040] Second, the present invention allows for caregiver 110 to remotely monitor one of the systems of a particular bed, such as bed 100a. Caregiver 110, using remote control 150, sends a request signal 171 to the location and tracking system through overhead transceiver 167d. The master station 170 receives this request signal and queries bed 100a over docking connection 120a for the requested information. The status of bed 100a or of patient monitors or devices on the bed 100a is then transmitted through the master station 170 to the remote control 150.

[0041] Bed 100, in one embodiment, contains a badge 350 similar to caregiver badge 160. Badge 350 transmits a bed identification signal 365 through a transmitter 355 (Fig. 5).

Bed identification signal 365 is monitored by overhead transceivers 167 coupled to the location and tracking system. The tracking of bed 100 allows caregivers to track the position of bed 100. Therefore, caregiver 110 is capable of querying the location of bed 100 with remote control 150 to determine if the bed has been returned to the patient room from surgery, testing, or additional tasks. In a preferred embodiment, caregiver 110 can program remote control 150 to continuously monitor the location of bed 100 and alert caregiver 110 when bed 100 has reached patient room 90a or other location.

[0042] Third, the present invention permits caregiver 110 to remotely perform tests or change the status of one of the systems of a particular bed, such as bed 100b. Caregiver 110, using remote control 150, sends a request signal 171 to the location and tracking system through overhead transceiver 167d. The master station receives this request and submits it to bed 100b over docking connection 120b. Bed 100b then carries out the requested test or function.

[0043] Docking connection 120, caregiver connection 135 and caregiver identification signal 155 are governed by a conventional wireless data communication protocol, such as infrared (IR), radio (RF), ultrasound or the like. Conventional IR links have problems in facilities wherein fluorescent lighting is used because fluorescent lights radiate IR energy and flicker at a rate which is similar to the modulation rate of an IR link. Therefore, the IR energy radiated by the flourescent lights at the approximate modulation rate of the IR link can interfere or drown out docking connection 120, caregiver connection 135 or caregiver identification signal 155. A preferred data communication protocol is Infrared Data Association's protocol (IrDA) which is not affected by the IR energy radiated by flourescent lighting.

[0044] The IrDA protocol is a protocol for wireless IR communication and is analogous to computer network protocols used to manage communication between computers on the same network cable. IrDA provides for a complex exchange of information between two components. This exchange includes identification information, a mechanism to acknowledge communication, error checking, error correction, and conflict resolution when there are two or more components with receivers receiving the same transmission. Therefore, IrDA not only works well with fluorescent lights, but also in a hospital environment wherein often more than one bed 100 is in a patient room.

[0045] An alternative embodiment uses digital pulse technology to control a multitude of beds wirelessly. It is understood that other transmission systems such as, for example, the Bluetooth radio technology may be used in accordance with the present invention. In addition, data transmission devices such as those disclosed in U.S. Patent Nos. 5,452,356; 5,481,255; and 5,735,285, which are incorporated herein by reference may also be used.

[0046] Docking connection 120 is illustratively a wireless communication link between bed 100 and docking station 105. Conventional hard-wired communication links which require a cable to be physically attached to the bed and the patient station, such as a RS-232 cable, are well known in the art. Docking connection 120 provides an exchange of information between bed 100 and the hospital network. In order to establish docking connection 120, bed transceiver 125 is positioned generally in front of docking transceiver 130 such that signals emitted by either are detected by the other.

[0047] Referring to Fig. 5, bed 100 includes a control unit 175 for controlling a set of monitoring devices 180, a set of record keeping devices 185, a set of frame and resting surface devices 190, a set of testing devices 195, a set of communication devices 200 and a set of environmental devices 205. In general, bed 100 is a conventional hospital bed including a frame, adjustable siderails and an articulated supporting surface for a patient. The various devices listed for bed 100 are known in the art and are provided as illustrative but not exhaustive examples of the different types of devices that can be controlled by the present invention.

[0048] Control unit 175 controls the communication between bed 100 and docking station 105. Bed transceiver 125 is connected to control unit 175. Additionally control unit 175 controls the operation of the other devices on bed 100.

[0049] Monitoring devices 180 are devices which monitor the state of bed 100, the state of the patient and the state of devices used to treat the patient. Referring to Fig. 6, several examples are shown, however Fig. 6 is not intended to be an exhaustive list of monitoring devices. Example monitoring devices 180 are bed sensors 210, brake sensors 215, a bed exit monitoring device 220, a patient position monitoring device 225, a ground fault monitoring device 230, a drug administration monitoring device 235, a folly bag monitoring device 240 and an incontinence monitoring device 245. When one of the monitoring devices 180 senses an undesirable bed, patient or equipment state it produces an

alarm condition. The alarm condition is relayed over docking connection 120 by control unit 175 to the hospital network. The alarm condition either sets off an indicator at the nurse's station 168 or is provided to the master station 170 for transmission over the location and tracking system to caregiver 110, or both. Caregiver 110 will receive an indicator, such as a visual indicator, on either badge 160 or remote control 150. Thus, even when the caregiver is located away from the bed 100, such as in a different room of the hospital, as in Fig. 3, the caregiver 110 is made aware of the alarm condition sensed by one of the monitoring devices 180.

[0050] Bed position sensors 210 monitor the position of bed 100. When the bed position sensors 210 sense an undesirable bed position, an alarm condition is generated and the nurse station 168 or the caregiver 110 is notified. An alarm condition represents that bed 100 is not in its correct position. Examples of an alarm condition are that the resting surface is not in the Trendelenburg or reverse Trendelenburg position; or that the bed 100 is not in a low position while the patient is resting. If an alarm condition is generated, then caregiver 110 can either physically enter the patient room and adjust the bed position by sending a signal through remote control 150 over caregiver connection 135 to frame and resting surface devices 190, by sending a signal over the hospital network to docking connection 120 from nurse's station 168, or by sending a signal over the hospital network to docking connection 120 from remote control 150 to control unit 175.

[0051] Brake sensors 215 monitor the brakes of bed 100. Hospital beds are typically provided with wheels to allow the bed to be transported easily from location to location. At least one of the wheels on bed 100 has a brake to secure bed 100 in a fixed location when the brake is in the set position. Brake sensors 215 monitor the status of the brake on bed 100. If the brake is not in the set position, bed 100 is free to roll and thereby cause possible injury to the patient. Brake sensors 215 notify nurse station 168 or caregiver 110 using docking connection 120 if the brake is not in the set position.

[0052] Bed exit monitoring device 220 monitors to make sure that the patient does not exit bed 100 without caregiver knowledge. One method to monitor if the patient has exited bed 100 is to monitor the weight of the resting surface of bed 100. A drastic reduction in the magnitude of the monitored weight indicates that the patient has exited the bed. If the patient does exit the bed, bed exit monitoring device 220 sends a signal through control unit

175 to docking station 105 using docking connection 120, and caregiver 110 is then notified on badge 160 or remote control 150.

[0053] Patient position monitoring device 225 monitors the position of the patient in bed 100. One method to monitor the position of a patient in bed 100 is to place a plurality of pressure sensors beneath the resting surface of bed 100. If the patient is not in his/her correct position on bed 100, patient position monitoring device 225 notifies caregiver 110 through docking connection 120.

[0054] Drug administration monitoring device 235 monitors, for example, an IV solution or drip solution. If a problem occurs, monitoring device 235 notifies caregiver 110 through docking connection 120.

[0055] Folly bag monitoring device 240 monitors a patient's folly bag and notifies nurse station 168 or caregiver 110 using docking connection 120 when the folly bag is full.

[0056] Incontinence monitoring device 245 monitors to make sure the resting surface of bed 100 remains dry. One method of monitoring for incontinence is to place a moisture sensor between the mattress and sheet of the resting surface. If excessive moisture is detected, incontinence monitoring device 245 notifies nurse station 168 or caregiver 110 using docking connection 120.

[0057] Record keeping devices 185 store information about the patient, their stay in the hospital, quality of care and equipment allocation. Fig. 7 shows several examples of record keeping devices 185, however, Fig. 7 should not be considered an exhaustive list. Example record keeping devices 185 are personal information 250, tare card 255, orders 260, vital signs 265 and care information 270. It is contemplated that all or some of record keeping devices 185 can be combined into one device such as the Graphical Caregiver Interface of the Hill-Rom Total Care® bed, an example of control box 109 (Fig. 2B). Record keeping devices 185 are updated by caregiver 110 through docking connection 120 or caregiver connection 135. Vital signs monitors 265 may also send information automatically to the record keeping devices 185. Thus, when a caregiver enters a patient's room, the caregiver may use remote control 150 to retrieve the patient's record data which is stored within memory of bed 100 or within memory at master station 170.

[0058] Personal information 250 provides the personal information about the patient including patient name, home address, social security number and emergency contact. Tare

card 255 provides a listing of the equipment which has been allocated to the patient, such as extra pillows or an IV unit. Tare card 255 provides easy inventory control and equipment tracking. Orders 260 tracks issued orders 262, completed orders 263, and currently pending orders 264 for the particular patient assigned to the bed. Along with providing a historical record, orders 260 provides the hospital staff with an indication of the quality of care provided to the patient.

[0059] Vital signs 265 allows caregiver 110 to record the collected vital signs of the patient such as blood pressure 266 (invasive and non-invasive cuff), body temperature 268 and patient weight 269. Other vital signs monitors 265 illustratively include heart rate or cardiac output sensors, EKG or ECG monitors, blood oxygen level monitors, capnographs, or the like. It should be noted that vital signs 265 are capable of being automatically recorded if a corresponding testing device 195 exists.

[0060] Care information 270 allows caregiver 110 to record the symptoms 274 of a patient such as back pain. Additional information can also be recorded such as food intake 271 and discharge volume 272. By compiling and analyzing the data collected by record keeping devices 185, an indication of the quality of care provided to the patient is generated. Other types of reports are also capable of being generated, such as a historical snapshot of the health of the patient. Additionally, billing reports are capable of being automated based on the recorded information.

[0061] Frame and resting surface devices 190 adjust the position of bed 100 and the position and shape of the resting surface. In addition, other devices are included in frame and resting surface devices 190, such as resting surface vibration, temperature and firmness controls. Caregiver 110 accesses and changes the state of frame and resting surface devices 190 either over docking connection 120 or over caregiver connection 135. Additionally, frame and resting surface devices 190 are capable of having patient inputs either on the bed frame or a patient remote control, such as control box 103 or control box 109. Fig. 8 shows several frame and resting surface devices 190, however Fig. 8 should not be considered an exhaustive list. Examples of frame and resting surface devices 190 include head position control 275, back position control 280, seat/thigh position control 285, heating control 290, firming bladder 295, retracting footboard control 300, turn assist bladder control 305 and vibration control 310.

[0062] Head position control 275, back position control 280 and seat/thigh position control 285 all alter the shape of the resting surface of bed 100. Head position control 275 raises or lowers the head position of the resting surface generally coincident with the head of the patient. Back position control 280 raises or lowers the middle portion of the resting surface generally coincident with the back of the patient. Seat/thigh position control 285 raises or lowers the lower portion of the resting surface generally coincident with the seat and thighs of a patient.

[0063] Heating control 290 controls the temperature of the resting surface of bed 100. Similarly, vibration control 310 controls the vibratory action of the resting surface of bed 100. Firming bladder control 295 controls the firmness of the resting surface of bed 100. Retracting footboard control 300 adjusts the length of the foot portion of the resting surface of bed 100. This allows bed 100 to accommodate patients of various heights comfortably. Turn assist bladder control 305 controls rotation of the patient to reduce the likelihood of pulmonary complications. An interface pressure sensor and controller for a patient support surface such as an air mattress may also be coupled to the controller 190.

[0064] In one embodiment, safety precautions are included when controlling frame and resting surface devices 190 with remote control 150. For example, when changing the position of the footboard through retracting footboard control 300, caregiver 110 is required to hold down a button on remote control 150 during the entire movement of the footboard for safety.

[0065] Testing devices 195 test various physical characteristics of the patient. Caregiver 110 performs tests with testing devices 195 either over docking connection 120 or caregiver connection 135. Additionally, testing devices 195 are capable of being setup to perform various tests at specific time intervals. The results of these tests are capable of being provided to caregiver 110 either over docking connection 120 or caregiver connection 135. Alternatively, the results are stored in a record keeping device 185 for future reference. Fig. 9 shows several testing devices 195, however Fig. 9 should not be considered an exhaustive list. Examples of testing devices 195 include blood pressure device 315, body temperature device 320, bed scale device 325 and pulse oximetry device 327.

[0066] Blood pressure device 315 illustratively includes automated blood pressure cuff and a control circuit which is used to monitor the blood pressure of the patient. It is

understood that any other blood pressure measurement apparatus may be used in accordance with the present invention. Body temperature device 320 includes a temperature sensor to monitor the body temperature of the patient. Bed scale 325 monitors the weight of the resting surface of bed 100 and based upon a knowledge of the weight of the resting surface when bed 100 is unoccupied, the weight of a patient positioned on the resting surface is determined. Pulse oximetry device 327 monitors the adequacy of the patient's circulation and if the delivery of oxygen to the tissues is adequate. Other testing devices include blood tests, capnographs, EKG or ECG devices, or the like.

[0067] Environmental devices 205 control environmental parameters within the patient room. Caregiver 110 can control environmental devices 205 either over docking connection 120 or caregiver connection 135. Fig. 10 shows several different environmental devices 205, however Fig. 10 should not be considered an exhaustive list. Examples of environmental devices 205 include TV/radio control 345, room temperature control 350 and lighting control 355.

[0068] TV/radio control 345 controls the functions of the TV and radio in the room. Room temperature control 350 is a thermostat control for altering the temperature of the patient's room. Lighting control 355 controls which lights are on or off in the room and at what brightness level.

[0069] In one embodiment, the status of the environmental controls is automatically altered when caregiver 110 enters the room. For example, the sound on TV/radio device 345 is muted and specific lights controlled by lighting 355 are activated. When caregiver 110 enters the room, bed transceiver 140 receives the caregiver identification signal 155 broadcast by caregiver badge 160. After the control unit 175 authenticates the identification signal 155, the control unit 175 instructs TV/radio device 345 to mute all sound and lighting device 355 to activate specific lights.

[0070] In another embodiment of the present invention, the control unit 175 overrides one or more of the environmental controls within the room once the control unit 175 authenticates the identification signal 155 from the badge 160. In other words, the patient can no longer control the environmental functions such as, for example, the radio, television or lighting when an authorized caregiver 110 is in the room. Input device 157 on the remote control 150 permits the authorized caregiver 110 to adjust the environmental controls to

desired levels.

[0071] Beds 100 often include lockout controls which prevent the patient on bed 10 from actuating certain controls. These lockouts are typically actuated by pressing a button or a combination of two or more buttons on the bed to lock out various bed controls, environmental controls, or other functions. In one embodiment of the present invention, these bed lockouts cannot be changed without an authorized caregiver 110 within the room. In other words, when caregiver 110 enters the room, the bed transceiver 140 receives the caregiver identification signal 155 from the badge 160. After the control unit authenticates the identification signal 155, control unit 175 then permits the bed lockout status to be changed.

[0072] Certain beds such as the TotalCare® bed available from Hill-Rom, Inc. are capable of moving from a generally flat bed position to a chair position. In one embodiment of the present invention, the bed is unable to move to a chair position unless an authorized caregiver 110 is located within the room. Again, the control unit 175 must receive and authenticate the identification signal 155 from badge 160 before the bed is permitted to move to the chair position.

[0073] Communication devices 200 govern communication between the patient and the hospital network. Fig. 11 shows several different communication devices 200, however Fig. 11 should not be considered an exhaustive list. Examples are telephone 330, touch screen 335 and nurse call 340.

[0074] Telephone 330 allows the patient to receive incoming telephone calls and place outgoing telephone calls. Telephone 330 communicates with the hospital telephone network over docking connection 120.

[0075] Touch screen 335 is an input device used to obtain information from the patient. One example is allowing the patient to select his/her menu choices with touch screen 335. The patient's choices are routed over docking connection 120 and the hospital network to the food preparation area of the hospital.

[0076] Nurse call 340 provides a two-way communication link between the nurse station 168 and the patient over docking connection 120. Additionally, the hospital location and tracking system provides an indicator to caregiver 110 on badge 160 or remote control 150 that a nurse call state has been initiated. In one embodiment, nurse call 340 deactivates

any alarm conditions initiated by bed 100 upon the detection of caregiver 110 near bed 100. When caregiver 110 enters the room, bed transceiver 140 receives the caregiver identification signal 155 broadcast by caregiver badge 160. After the control unit 175 authenticates the identification signal 155, the control unit 175 instructs nurse call device 340 to deactivate all alarms initiated by bed 100.

[0077] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description is to be considered as exemplary and not restrictive in character, it being understood that only exemplary embodiments have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.